

# NASA's Return On Investment Report

Issue 12

May 2013



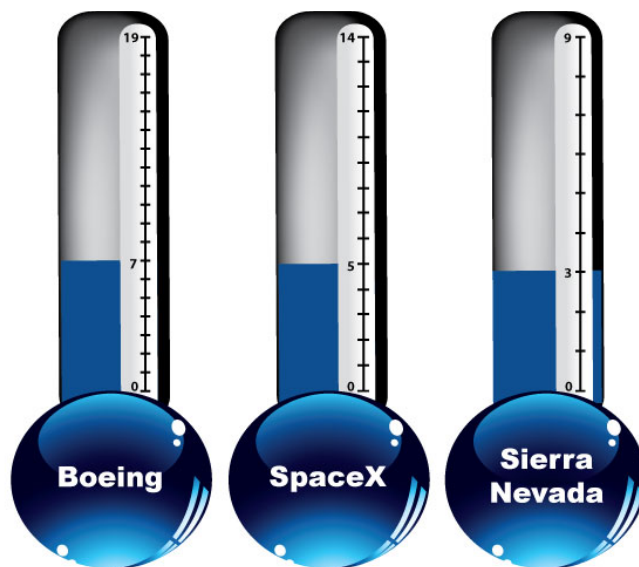
*This bi-monthly newsletter of accomplishments, progress, and happenings in NASA's commercial crew and cargo development programs is distributed by the Commercial Spaceflight Development Division at NASA Headquarters.*

## Commercial Crew Partners Continue to Successfully Achieve More Milestones

NASA's Commercial Crew Integrated Capability (CCiCap) partners continue to meet all scheduled CCiCap milestones, bringing the nation closer to its goal of having a U.S. capability for human access to space and ending reliance on foreign vehicles. Since August 2012, 15 of the 42 planned milestones have been successfully completed.

In March, Boeing completed the Launch Vehicle Adapter (LVA) Preliminary Design Review (PDR), demonstrating the preliminary design of the LVA met mission requirements with an acceptable risk and within the cost and schedule constraints. The LVA attaches the CST-100 spacecraft to the Atlas V launch vehicle. The successful PDR provides the basis for proceeding to the next design phase: the detailed design of the LVA. In April, Boeing completed its integrated vehicle wind tunnel test to fully understand the aerodynamic wind buffet environments over the launch vehicle and reduce potential design risks.

SpaceX completed its Pad Abort Test Plan Review in March. The eventual pad abort test will demonstrate the effectiveness of the crew Dragon spacecraft launch abort system in a pad abort scenario. The pad abort test article consists of a Dragon test capsule sitting on top of a trunk structure in the center of the pad. A successful abort test will carry the Dragon capsule away from the launch pad and towards the ocean. The main parachutes will deploy once the capsule is stabilized. The Review Milestone determined that the test article is capable of meeting the pad abort test requirements and schedule. Garrett Reisman, Crew Dragon program



CCiCap milestone completion status—Boeing: 7 of 19.  
SpaceX: 5 of 14. Sierra Nevada: 3 of 9.



Boeing conducts wind tunnel testing of their integrated commercial crew transportation system under CCiCap.  
*Photo courtesy of Boeing*

manager for SpaceX said, "SpaceX is committed to making Dragon one of the safest spacecrafts ever flown. In partnership with NASA, we are moving steadily towards this goal and look forward to returning human spaceflight capabilities to the U.S."

Sierra Nevada Corporation (SNC) continues to make progress readying its Engineering Test Article (ETA) for flight testing this summer. The vehicle was shipped to NASA's Dryden Flight Research Center in May, where further assembly, integration and testing is being performed. In addition to the ETA work, Dream Chaser subsystems are undergoing testing in support of future CCI Cap milestones, which include ongoing wind tunnel testing of the thermal protection system design



Sierra Nevada's Dream Chaser, next to its cousin the M2F1, one of the original lifting bodies. These 2 lifting bodies were viewed by NASA Administrator Charlie Bolden on May 22, 2013 during his visit to Dryden Flight Research Center.

*Photo courtesy of Sierra Nevada Corp.*

and testing of its green propulsion system. Jim Voss, SNC vice president of Space Exploration Systems and Dream Chaser program manager, said "we are excited to be working with NASA's Dryden Flight Research Center for our flight tests. The value of the partnership between SNC and NASA is highlighted by having the world's best flight test organization assisting with our Dream Chaser test program. This gives us confidence that the upcoming flights will be successful. Having landed in the Shuttle at Dryden I have first hand knowledge of the great work done by the DFRC team."

## The Importance of Orbital's Recent Successful Demo Flight and Having Multiple Commercial Providers

The successful launch of Orbital Science Corporation's Antares rocket brings the United States one step closer to having two fully-functional cargo ships available to ferry vital experiments, cargo and supplies to the International Space Station.

A core tenant of the space station partnership is "dissimilar redundancy." One of the legacies of the international partnership created during space station development was that many critical systems were designed in parallel, resulting in things such as two carbon dioxide removal systems, two oxygen generation systems, and other systems being built and flown in space at the same time. This was not an accident; a failure that affects the U.S. Oxygen Generation System is highly unlikely to affect the Russian Elektron oxygen system—a design that is completely different. Similarly, a failure of the Russia Vozdukh carbon dioxide system will not affect the U.S. Carbon Dioxide Removal Assembly.

This same philosophy of dissimilar redundancy is critical to cargo transportation to space station, and will be critical to the development of NASA's Commercial Crew Program. The successful completion of the Antares demonstration flight to space station will restore full U.S. redundancy to cargo transportation, along with NASA's Commercial Resupply Service partner SpaceX. The International Space Station Program's cargo redundancy—rounded out by the European Automated Transfer Vehicle, the Japanese H-II Transfer Vehicle; and the Russian Progress—is such that space station can absorb a failure of any one of these systems without a major impact to on-orbit operations. Dissimilar redundancy is a sound engineering philosophy to which the space station program, along with its international and commercial partners, continues to adhere today.

According to Sam Scimemi, director of the International Space Station program at NASA Headquarters, "The long term viability and utilization of space station is dependent on two operational domestic cargo providers. Though currently there are multiple cargo providers across the partnership, there will be reductions in the availability in the future especially the ATV and HTV. Furthermore, spaceflight is inherently a challenging

endeavor and no system is immune to significant anomalies or failures. Having two domestic cargo providers ensures that NASA's mission in low-Earth orbit and on station is achievable."

## ISS TRANSPORTATION SYSTEMS

134 Flights to ISS (so far)



**Shuttle**  
37 flights  
(retired)



**Proton**  
2 flights



**Soyuz / Progress**  
35 Soyuz  
51 Progress  
2 Assembly



**Ariane V/ATV**  
3 flights



**H-IIIB/HTV**  
3 flights



**Commercial Resupply Services**  
**SpaceX**  
3 flights



**Orbital**  
1<sup>st</sup> Flight 2013

**Of 78 launches globally in 2012, 12 (15 percent) went to ISS**

Download the latest and greatest information here: <http://go.nasa.gov/commercial-documents>

- [Phil McAlister's Presentation to NASA Advisory Council's Exploration Committee](#)

For more information on any of the articles in this report, contact Joshua Buck, Rachel Kraft, or Trent Perrotto in NASA's Public Affairs Office at 202-358-1100. To review NASA's other commercial space accomplishments, visit: <http://www.nasa.gov/commercial/>